



Recommissioning Existing Labs To Realize Energy Savings



Utilities and Energy Management
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Agenda

- Overview of Cornell University
- Energy Conservation Initiative (ECI)
- ECI recommissioning program
- Questions and answers



Cornell University

- 18,000 student body
- 12,000 faculty/staff
- 745 acre campus
- Endowed, Contract Colleges, & Campus Life



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Cornell University

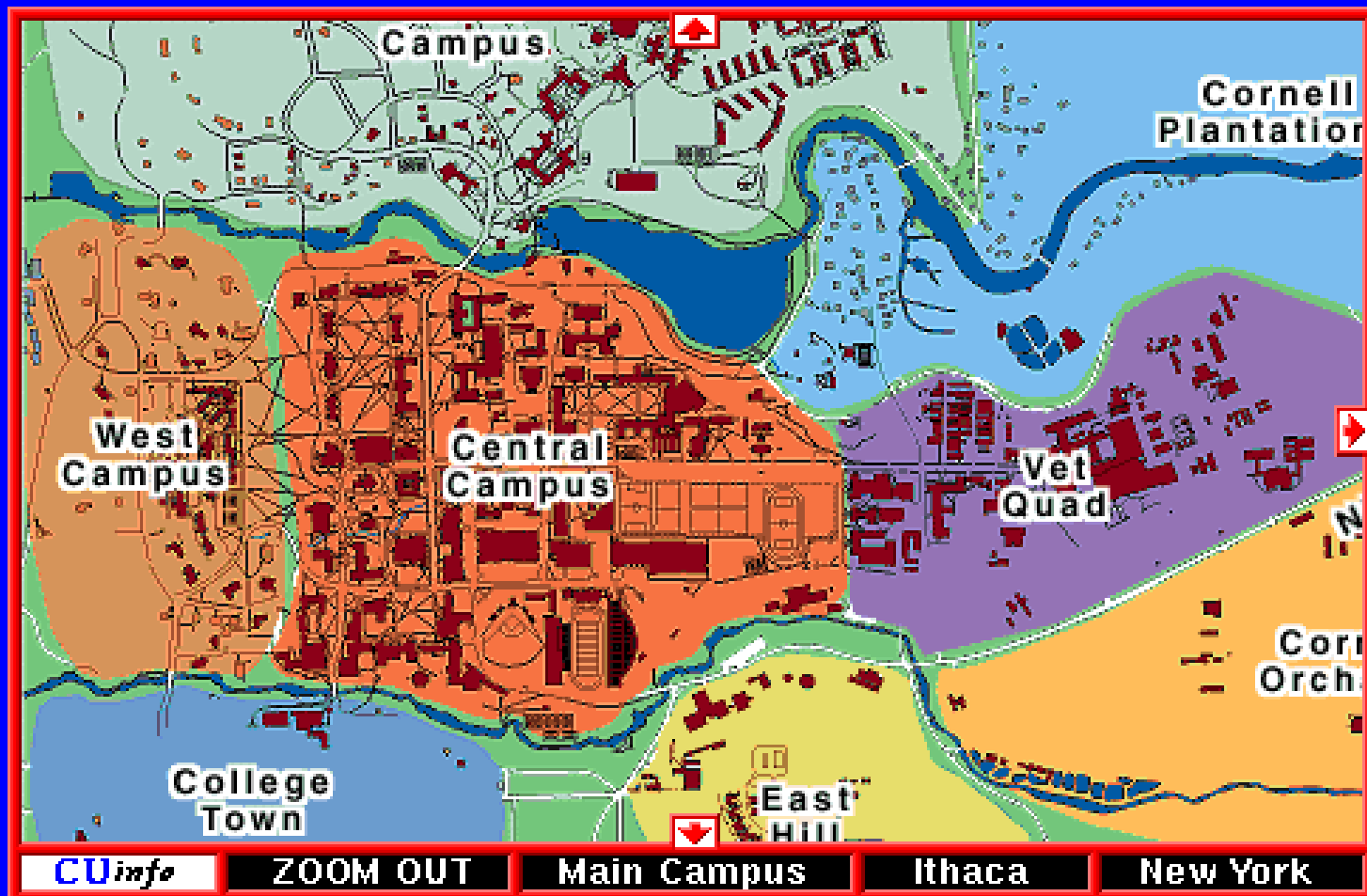
- 260 buildings; 13,600,000 sf
- \$36 million total energy cost
- Average energy cost \$2.65/sf
- Average energy input 179,000 btu/sf
- Average metered use 212,000 btu/sf *

* Includes cooling



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Cornell University (Endowed)

Description	Existing	Planned	Total
Lab Buildings	20	5	25
Sq. Footage	2,400,000	570,000	2,970,000
Fume Hoods	500	200	700
Energy Cost	11,000,000	3,000,000	14,000,000
Average \$/sf	4.60	5.50	4.70
* Projects planned for completion by 2010 total \$500 million			



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- Existing utility infrastructure
 - 115kV electric substation
 - Central heating plant
 - 90% coal, 8 MW cogen
 - Central chilled water plants
 - Lake Source Cooling



Cornell University

Existing Utility Infrastructure Loads

Utility	Average	Peak	Units
Electric	27	35	MW
CHP	125	375	klbs/hr
CWP	4,300	18,000	tons



Cornell University

- Projects planned will strain infrastructure
- Chartered Kyoto Task Team
- Expanded energy management program
- Created ECI

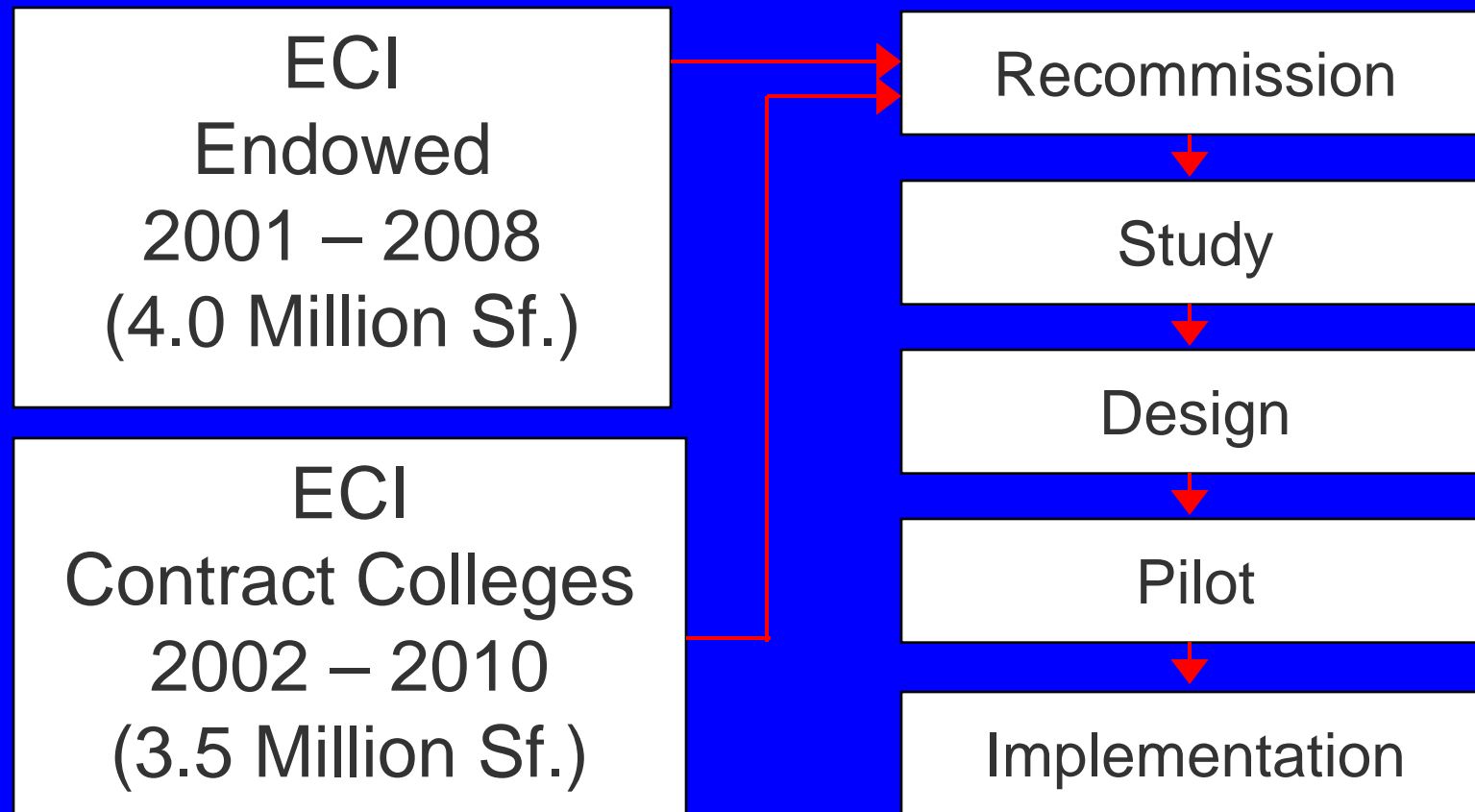


Energy Conservation Initiative

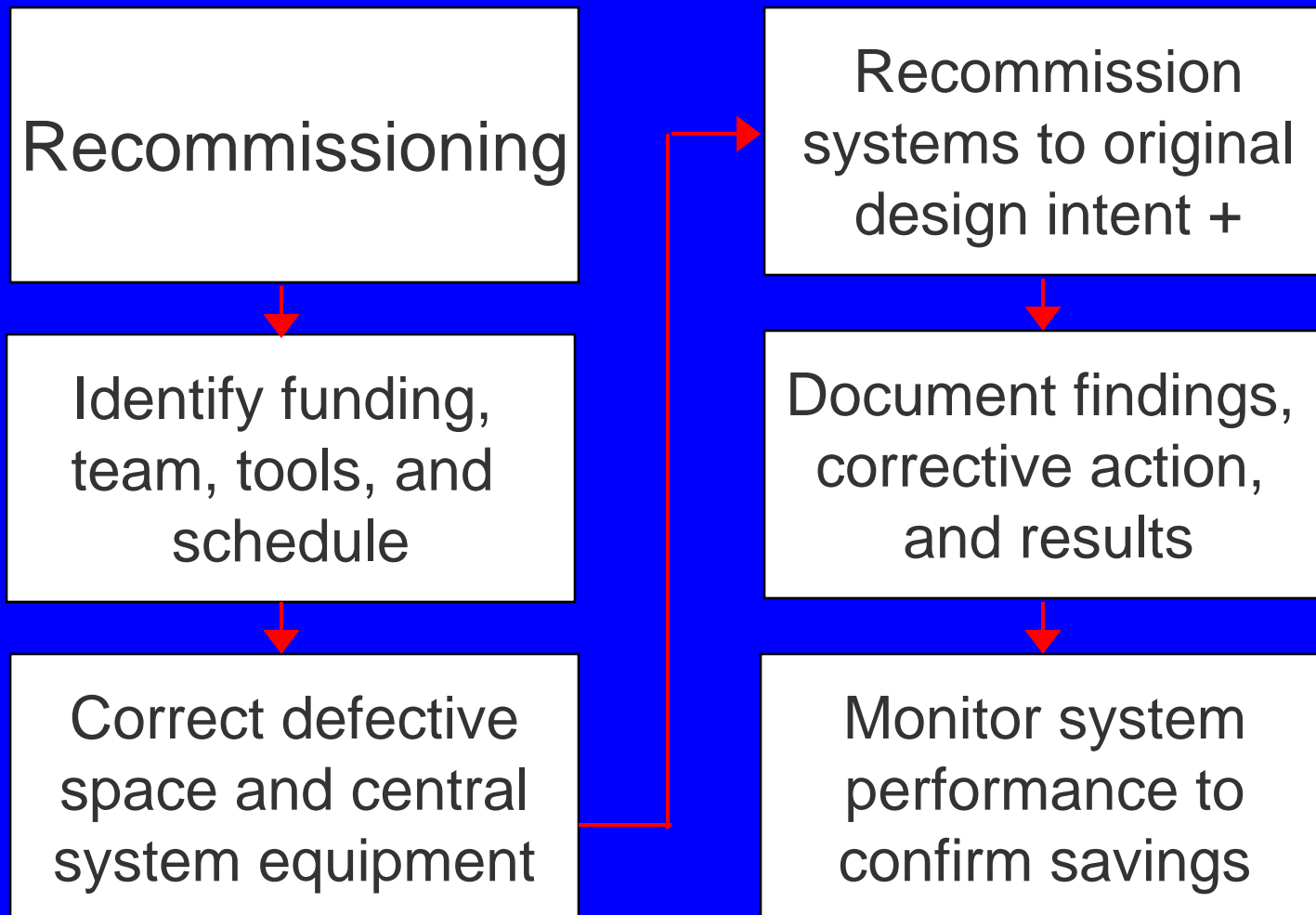
- Goal = reduce energy use by 20%!
- Multi-phase seven year plan
- Recommissioning → studies → pilots → projects
- NYSERDA support for studies
- Maintenance & continuous commissioning
- Outreach & education



Energy Conservation Initiative



ECI Recommissioning



ECI Recommissioning

- Identify funding, team, tools, & schedule
 - Establish funding source
 - Commit senior technicians for duration
 - Purchase & calibrate dedicated tools
 - Prepare detailed work & progress schedule



ECI Recommissioning

- Correct defective space/central equipment
 - CAV/VAV boxes, dampers, valves
 - Sensors, transducers, transmitters
 - DDC, EMC systems
 - AHU's, pumps



ECI Recommissioning

- Recommission to original design intent +
 - Locate CD's, TAB reports, & submittals
 - Identify air flows & hood face velocities
 - Adjust set points & control sequences
 - Improve where possible

ECI Recommissioning

- Document findings, corrections, & results
 - Prepare recommissioning forms
 - Record findings & corrective action taken
 - Log equipment/system performance data
 - Archive in secure & accessible location



ECI Recommissioning

- Monitor performance to confirm savings
 - Benchmark initial performance data
 - Trend & evaluate monthly performance data
 - Regularly compare initial v. monthly data
 - Tune as necessary
 - Confirm savings



ECI Recommissioning Results

- 42 buildings recommissioned
- Total 4 million sf ~ \$400,000
- Central mechanical room equipment
- Limited space controls
- 2 full-time senior technicians
- 24 month duration



ECI Recommissioning Results

Endowed buildings – 4 million sf *

Year	Total btu ** (x 10 ⁶)	btu/sf	HDD
1999-2001(Avg)	837	209,000	6,875
2001-2002	846	211,000	6,163
2002-2003	848	212,000	7,526

* 2.4 million sf lab buildings

** In '02/03 steam = 44%, electric = 32%, chilled water = 24%



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ECI Recommissioning Results

Endowed buildings – 4 million sf

Year	Total btu Δ	btu/sf Δ	HDD Δ
02/03 vs. 01/02	+ < 1%	+ < 1%	+ 22%
02/03 vs. 99/01	+ 1%	+ 1%	+ 10%



ECI Recommissioning Results

- Typical findings
 - Defective AHU equipment & boxes
 - Incomplete algorithms & schedules
 - Overridden & disabled features
 - Miscalibrated sensors & transmitters
 - Non-functioning EMCS tools

ECI Recommissioning Results

- Continuous commissioning
 - Initial performance data benchmarked
 - Trends & graphics evaluated quarterly
 - Systems tuned as required
 - Data, results, & lessons documented



ECI Recommissioning Example

Olin Hall – Chemical Engineering



ECI Recommissioning Example

- 130,000 sf; 35,000 sf = 40 fume hood labs
- Average energy use 217,000 btu/sf
- Pneumatic space control
- Excessive air change rates: 60,000 cfm
- Central air fans at full speed

ECI Recommissioning Example

- 12 ac/hr → 8 ac/hr (↓10,000 cfm)
- Fume hood VAV set at 100 fpm
- 3-box room air flow functioning
- Highly variable occupancy
- Identified high sensible heat load area
- 1 FTE for 1 month = \$15,000 cost
- @ \$5.00/cfm = \$50,000/year savings



ECI Recommissioning Example

Vet Medical Center



ECI Recommissioning Example

- 320,000 sf; 45,000 sf = 43 fume hood labs
- Average energy use 346,000 btu/sf
- Digital space control
- Excessive air rates, noise, cold spaces
- Central air fans at full speed: 140,000 cfm



ECI Recommissioning Example

- 15 ac/hr → 8 ac/hr (↓ 50,000 cfm)
- Fume hood VAV set at 100 fpm
- Rebuilt AHU valves & humidifiers
- Installed occupancy sensors
- Software reviewed, corrected, standardized
- \$200,000 cost
- @ \$5.00/cfm = \$250,000/year savings



Conclusion

- Recommissioning, is it worth it?

Absolutely



- What did we learn?
 - Question standard practices
 - Work with building staff
 - Data, data, data
 - Plan → do → check → act

Conclusion

Questions?

